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Publication Title:

DRY DIVING SUITS

Abstract:

Abstract of GB 1518065

(A) 1518065 Dry diving suit TRELLEBORGS GUMMIFABRIKS AB 21 Feb 1977 [25 Feb 1976] 07140/77 Heading A3V A dry diving suit is formed of elastomeric coated fabric and has a water proof zip 11 and sealable cuffs 23, the inside of the hood 15 being lined with a heat insulating pressure equalising material such as wet spun nylon fabric held in place with a burr fastener 25 around the facial opening. An elastomeric foam material (neoprene) pad 26 is provided for comfort and straps 18, 19 and buckles 20, 21 are provided on the outside of the hood to tighten the hood in the region of the facial opening.

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(54) IMPROVEMENTS IN OR RELATING TO DRY DIVING SUITS

(71) We, TRELLEBORGS GUMMIFABRIKS AKTIEBOLAG, a company duly organized and existing under the laws of Sweden, of Nygatan 102, 231 00 Trelleborg, Sweden, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a dry diving suit of liquid-tight elastomer-coated substantially non-extensible fabric in the form of an overall having a fixedly attached outer hood and foot-covering and being provided with one or more water-proof zippers for permitting taking off and putting on the suit.

As early as the 1940's, a dry light-weight diving suit was developed (see for instance Swedish Patent Specification 133,147) which consisted of a water-proof rubberized woven fabric and which, as opposed to the so-called wet suits, keeps the diver dry. These dry suits have since been further improved by and by, Swedish Patent Specification 309,728 and corresponding British Patent Specification 1,224,184 disclosing a dry suit in the form of a snugly fitting overall with fixed hood and foot-covering. This prior art suit is made of a heat-insulating foam elastomer with closed cells and substantial stretchability. On the inside of its neck region, the suit has collar-like sealing means for preventing air from penetrating up into the diver's hood. This prior art suit has a water-proof zipper to permit putting on the suit. This operation brings about stretching of the suit material, at any rate as the head is passed into the diver's hood which is also manufactured for a tight fit. This known suit is advantageous in some respects, but is not particularly suited for instance for rescue workers and other personnel who must get into a dry suit in a very short time without removing their ordinary clothing beforehand. Consequently, such suits restrict the type of material used to the original rubberized fabric, attempts having then been made to prevent, as far as is possible, air from escaping from the interior of the suit via the facial opening. To this end, the diver's hood has been manufactured as a liquid-tight detachably mountable unit of a thin supple elastic sheet material, usually made of neoprene or natural rubber, having sufficient extensibility such that the diver's hood may be passed over the head into tight fit with respect thereto, in order to provide sufficient sealing around the facial opening. However, such a construction suffers from a number of drawbacks, int. al. in that the connection of the hood with the suit is complicated and above all time-consuming to carry out when putting on the suit. Thus, attempts have been made to manufacture the suit of rubberized cloth with a fixed hood of the same material as the suit. These attempts have not been very successful, since it has proved difficult to prevent air from escaping via the facial opening and since unsuitably large air pockets collect in the neck and hood portions of the suit.

In view of the above, the present invention has for its object to provide a dry diving suit of elastomer-coated substantially non-stretchable liquid-tight fabric in the form of an overall having a fixed outer hood and foot-covering and provided with one or more water-proof zippers to permit putting on and taking off the suit. In order to overcome the above-discussed and also other drawbacks, the dry suit according to the invention has an inner hood which is connected, preferably in a detachable fashion, to said outer hood of elastomer-coated fabric, in the proximity of a lip-seal of supple elastomer sheet material surrounding the facial opening of the outer hood. said inner hood enveloping the entire head and extending downwardly along the wearer's neck and being made of a heat-insulating pressure equalizing material. Moreover, said outer hood of elastomer-coated fabric, including the neck region thereof, has a sufficient width to permit putting on and taking off the suit and is provided with tightening means, preferably straps, which are so disposed that, on being tightened, they reduce the effective width of the outer hood on a level with the facial opening thereof.

Thus, the dry suit according to the invention should be provided with an inner

hood connected to the outer hood of the suit consisting of elastomer-coated fabric adjacent a lip-seal of supple elastomer material surrounding the facial opening of the outer hood. The inner hood shall envelop the entire head and extend downwardly along the neck of the wearer and consist of a heat-insulating pressure equalizing material. Further, the driver's outer hood of elastomer-coated fabric, including the neck region thereof, should according to the invention be of a sufficient width to permit putting on and taking off and be provided with tightening means. These tightening means should be so positioned that, on being tightened, they will reduce the effective width of the outer hood on a level with its facial opening. The tightening operation, in the first place, aims at pulling the lip-seal which encircles the facial opening of the outer hood backwardly so as to fit more tightly against the face of the wearer. In addition, this tightening serves to squeeze together the outer and inner hoods in order to prevent harmful accumulation of air within the other parts of the hood and to reduce the risk of air penetrating upwardly in between the wearer's head and the inner hood and also between the inner and outer hoods. Consequently, the result of this tightening is that the lip-seal encircling the facial opening will be drawn more tightly against the face and that it will be more difficult for air to penetrate upwardly in between the inner hood and the diver's head, and that a smaller amount of air will accumulate in the outer hood.

The inner hood of the suit preferably consists of at least one inner head-insulating layer of preferably synthetic wadding and, disposed on either side thereof, surface layers of preferably synthetic fabric, preferably wet spun nylon fabric. This inner hood is preferably detachably fixed to the outer hood by means of burr fastener tapes, e.g. Velcro tapes, encircling its facial opening. To this end, one burr fastener tape half is fixed on the inside of the diver's outer hood and the other burr fastener tape half (the complementary one) is fixed at the edge of the facial opening of the inner hood. Such a detachable mounting of the inner hood entails several advantages. A particularly important advantage is that the rescue workers, for hygienic purposes, can have one inner hood each, irrespective of whether one and the same suit is worn by different persons on separate occasions. In addition to being heat-insulating, the inner hood has a pressure equalizing effect, i.e. serves as a cushion equalizing the squeezing pressure which the outer hood and folds thereon will exert against the head.

It is particularlly advantageous if the burr fastener tape half fixed on the outer hood forms a pocket together with the outer hood and if the inner hood is inserted with its burr fastener tape half in this pocket. In relation to the wearer's face, the burr fastener tape covered surface of the inner hood is then oriented towards the face and the burr fastener tape covered surface of the outer hood is oriented away from the face of the wearer.

The tightening means on the outer hood preferably consists of at least two tightening straps which are fixed on the outer side of the outer hood approximately on a level with the ears of the wearer. These straps extend backwardly around the back of the head of the user and are adapted, on being tightened, to contract the suit and the inner hood and to pull the lip-seal encircling the facial opening backwards in order to produce the above-mentioned effect.

The invention will be more fully described hereinbelow with reference to the accompanying drawings, in which:

Fig. 7 is a side elevational view, showing the upper portion of a suit according to the present invention, the suit being put on and the straps tightened;

Fig. 2 represents the same view as Fig. 1 but in cross-section;

Fig. 3 shows the suit seen from the other side, the straps being, however, not tightened;

Figs. 4 and 5 show the suit, as seen from in front, the straps being tightened in Fig. 4, whereas not in Fig. 5;

Figs. 6 and 7 show the suit from the rear, the straps being tightened in Fig. 6, whereas not in Fig. 7;

Fig. 8 illustrates the entire dry suit, as seen from in front; and

Fig. 9, on a larger scale, illustrates the portion IX in Fig. 2.

The suit according to the invention is a one piece suit in the form of an overall having a water-proof zipper 11 which permits putting on and taking off the suit and which departs from the rear side of one shoulder to extend obliquely downwardly across the chest of the wearer and almost reaches his knee on the opposite side. The suit 10 further has fixed foot-covering, for instance boots 22, as seen in Fig. 8. Sealing of the outer ends of the sleeves against water may be obtained with the aid of tightenable cuffs 23 or by means of gloves which may either be permanently secured to the suit or connected to the cuffs of the suit in a water-proof fashion. Moreover, the suit further comprises an outer hood 12 which is connected to the rest of the overall-like suit in a water-proof fashion. This outer hood 12 has a facial opening 13 surrounded by a lip-seal 14 being glued at 24 to the outer hood 12 (Fig. 9).

As is evident from Figs. 2 and 9, the

outer hood 12 is made of an elastomer-coated fabric layer 15. Inside the outer hood 12, there is provided an inner hood 16 of heat-insulating pressure equalizing material. In the illustrated embodiment, the inner hood 16 consists of at least one inner heat-insulating layer of preferably synthetic wadding and, disposed on either side thereof, surface layers of preferably synthetic fabric, particularly wet spun nylon fabric. The inner hood 16 envelops the entire head of the wearer, apart from the region surrounding the nose, mouth and eyes, and extends downwardly along the neck of the wearer. At the edge proximal to the facial opening 13, the inner hood is inserted into a pocket which is formed between the suit material 15 of the outer hood and a flap 17 fixed to the inner side thereof and having a burr fastener strip which has its burr surface oriented away from the face. On the inside of the inner hood within the marginal area proximal to the facial opening 13 there is fixed a complementary burr fastener strip having its connecting surface oriented inwardly towards the face, such that the inner hood by means of the burr fastener strips is maintained in correct position in the outer hood 12. In Fig. 9, the burr fastener strip assembly is designated 25.

As is evident from Fig. 9, there is fixed on the inner side of the outer hood 12 a strip 26 of elastic foam material having closed cells, preferably foam neoprene. Since the strip 26 is secured to the non-extensible portion 24 of the outer hood, it will act as sealing means and assists in preventing air from escaping out of the hood through the facial opening 13.

On the outside of the outer hood 12 on a level with the ears of the wearer, there are secured two tightening straps 18, 19 which may be tightened against the back of the head of the wearer by means of clasps 20, 21.

As will appear from Figs. 3, 5 and 7, the proper hood of the suit, i.e. the outer hood 12, has been given such a width to permit the wearer easily to pass his head up into the hood when putting on the suit. The same applies to the inner hood, if it is manufactured from a non-extensible material.

As appears from a comparison between Figs. 1 and 3 and between Fig. 4 and Fig. 5, it will be appreciated that the tightening of the straps 18, 19 will reduce the effective width of the outer hood 12 on a level with the ears of the wearer. Besides, the result of such a tightening is that the sealing flap 14 is pulled backwardly and thus stretched to be firmly drawn against the face of the user. Such a stretching will be clearly seen from a comparison of Figs. 1 and 3.

The inner hood 16 of heat-insulating material will cause a pressure equalization and thus prevent painful squeezing of the skin on tightening of the straps 18, 19. Moreover, the inner hood provides heat insulation which enhances comfort and saves the head of the wearer from being cooled more than the other parts of his body. As indicated above, the wearer is allowed to keep on his ordinary clothes, for instance a uniform, since the rest of the suit has a more loose fit.

The suit according to the invention can be utilized in combination with a breathing mask or in combination with a face mask and a mouth piece for supply of breathing gas. Though not shown in the drawings, the suit may also be provided with valves for supply and discharge of air from the space between the wearer and the suit, as indicated in for instance the above-mentioned Swedish and British patent specifications.

WHAT WE CLAIM IS:—

1. A dry diving suit of liquid-tight elastomer-coated substantially non-extensible fabric in the form of an overall having a fixedly attached outer hood and foot-covering and being provided with one or more water-proof zippers for permitting putting on and taking off the suit, wherein the suit comprises an inner hood which is connected, preferably in a detachable fashion, to said outer hood of elastomer-coated fabric, in the proximity of a lip-seal of supple elastomer sheet material surrounding the facial opening of the outer hood, said inner hood enveloping the entire head and extending downwardly along the wearer's neck and being made of a heat-insulating pressure equalizing material, and wherein said outer hood of elastomer-coated fabric, including the neck region thereof, has a sufficient width to permit putting on and taking off the suit and is provided with tightening means, preferably straps, which are so disposed that, on being tightened, they reduce the effective width of the outer hood on a level with the facial opening thereof.

2. Dry suit as claimed in claim 1, wherein the inner hood consists of at least one inner heat-insulating layer of preferably synthetic wadding and, disposed on either side thereof, surface layers of preferably synthetic fabric.

3. Dry suit as claimed in claim 1 or 2, wherein the inner hood is detachably fixed to the outer hood of the suit by means of a burr fastener tape assembly which extends around the facial opening of the outer hood and one half of which is fixed to the inside of the outer hood, and the other half to the edge of the facial opening of the inner hood.

4. Dry suit as claimed in claim 3, wherein the burr fastener tape half fixed to the outer hood forms a pocket with the outer

hood, and wherein the inner hood is inserted with its burr fastener tape half into this pocket.

5. Dry suit as claimed in any one of the preceding claims, wherein the tightening means comprise at least two straps which are attached to the outer side of the outer hood approximately on a level with the wearer's ears and which extend backwardly around the back of the head of the wearer in order, on being tightened, to contract the outer hood and the inner hood and to pull the lip-seal encircling the facial opening backwardly.

6. Dry suit as claimed in any one of the preceding claims, wherein a strip of elastic foam material having closed cells is fixed to the inner side of the outer hood at the connection thereof with the lip-seal.

7. A dry diving suit, substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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1518065 COMPLETE SPECIFICATION
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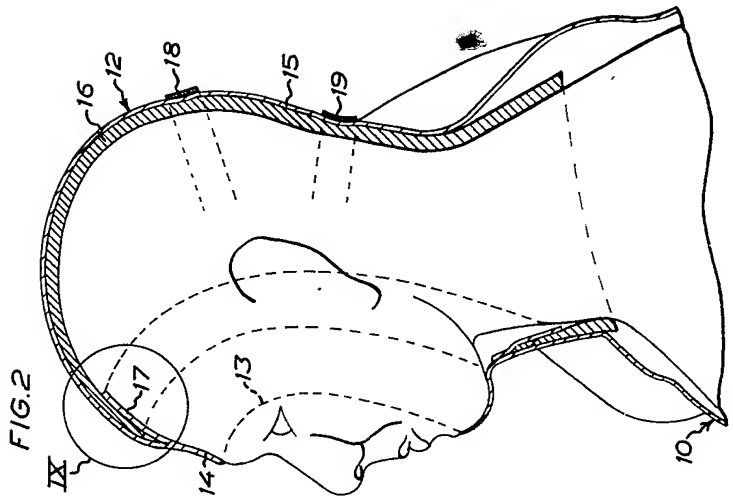

FIG.2

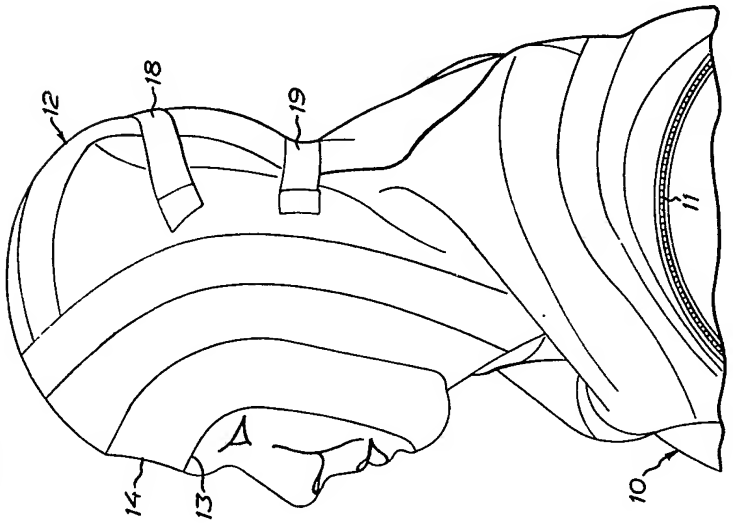

FIG.1

1518065 COMPLETE SPECIFICATION
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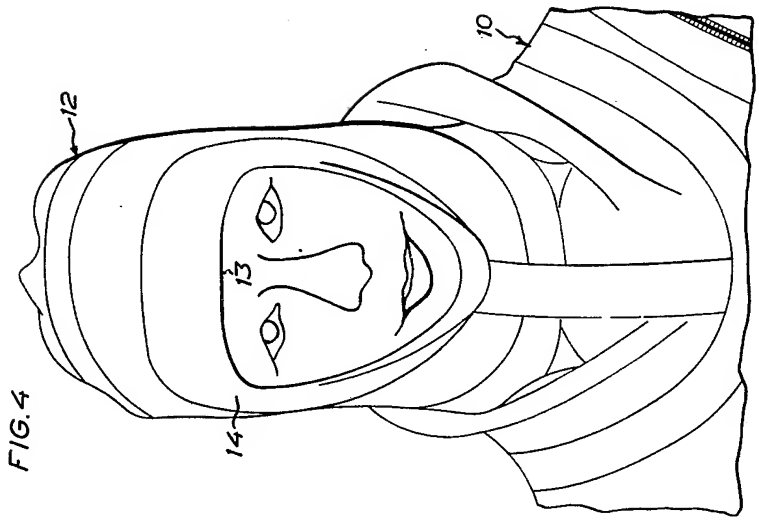

FIG.4

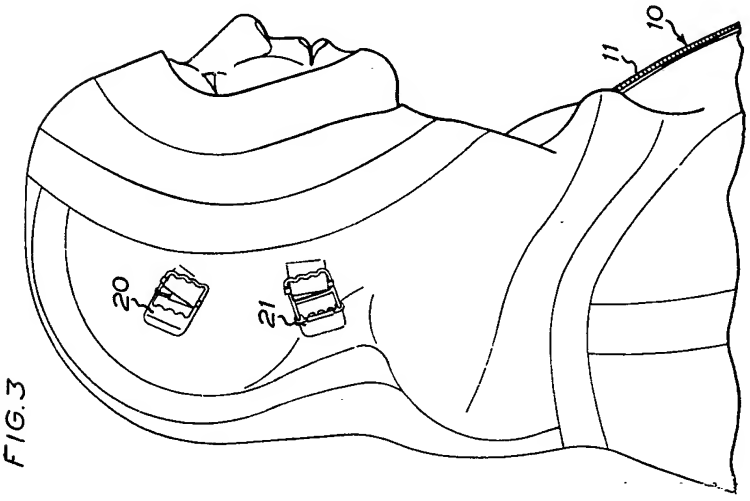

FIG.3

1518065 COMPLETE SPECIFICATION
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Sheet 3

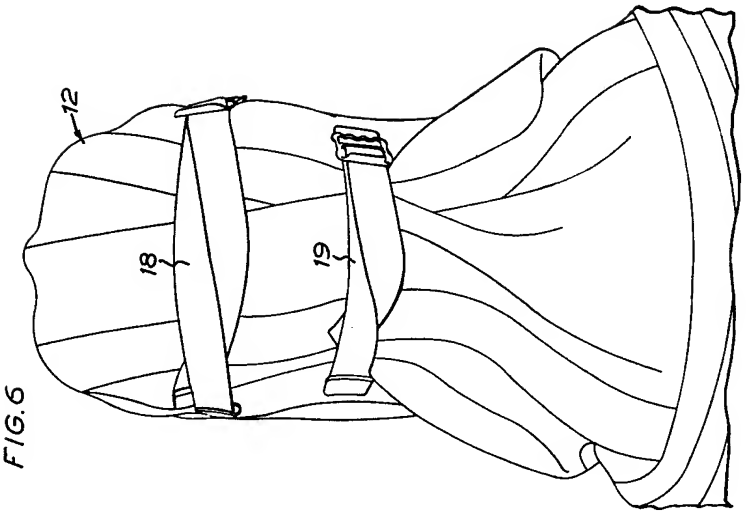

FIG.6

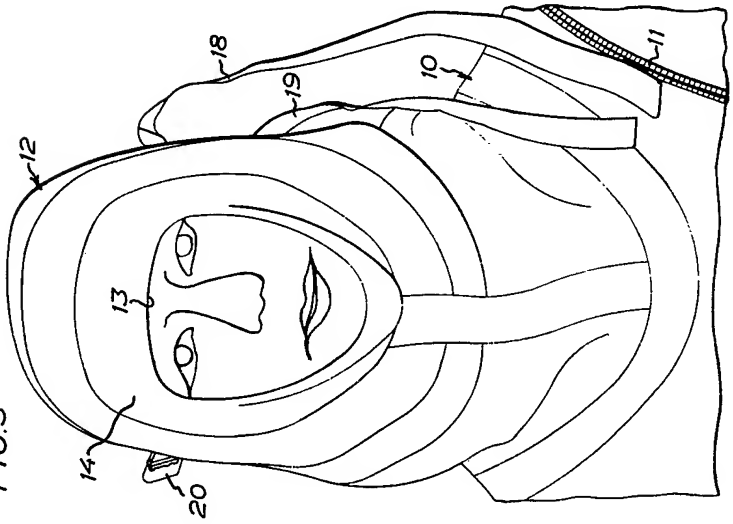

FIG.5

1518065 COMPLETE SPECIFICATION
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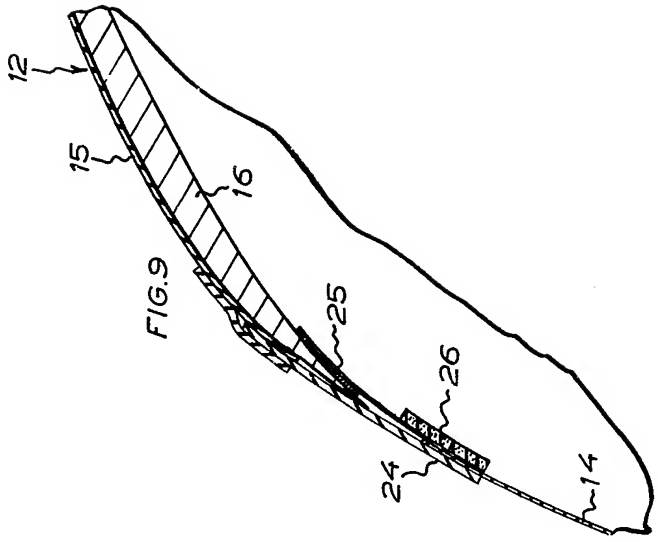

FIG.9

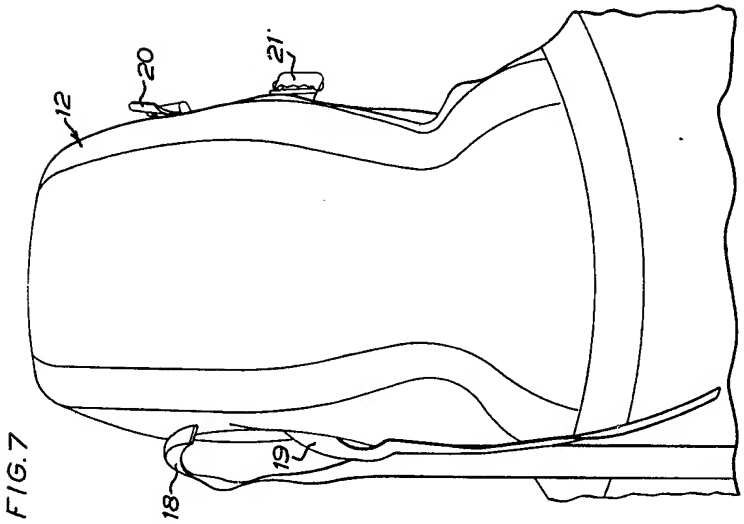

FIG.7

1518065 COMPLETE SPECIFICATION
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Sheet 5

FIG.8